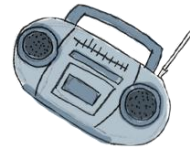**How Loud is Too Loud?**
Written by GEF Staff

Grades: 3-5
Subjects: Science, Health, Social Studies, Language Arts
Time: Two 45 minute sessions

* Standards: Students will…

Science Standard 5: Understand the structure and function of cells and organisms.
Benchmark # 3: Know that the behavior of individual organisms is influenced by internal cues (e.g., hunger) and external cues (e.g., changes in the
environment), and that humans and other organisms have sense that help them detect these cues (e.g., the sense of hearing can detect loud noise).

Science Standard 6: Understand relationships among organisms and their physical environment.
Benchmark # 4: Know that changes in the environment can have different effects on different organisms (e.g., some noises bothers all organisms, while
other noises bother only some organisms, or none at all).
Benchmark # 5: Know that all organisms (including humans) cause change in their environments, and these changes can be beneficial or detrimental
(e.g., some noise is so loud it can cause physical harm to living organisms).

Technology Standard 3: Understand the relationship among science, technology, society and the individual.
Benchmark # 5: Understand that technology may affect the environment both negatively and positively (e.g., a mass transit system may reduce the number of
cars in the air, but may also increase the levels of noise pollution).

Health Standard 2: Know environmental and external factors that affect individual and community health.
Benchmark # 1: Know how the physical environment can impact personal health (e.g., the effects of exposure to various pollutants, such as noise pollution).
Benchmark # 2: Know how individuals, communities and states cooperate to control environmental problems and to maintain a healthy environment.

Geography Standard 18: Understand global development and environmental issues.
Benchmark # 3: Know how differences in perception affect people's interpretations of the world.

Language Arts Standard 1: Use the general skills and strategies of the writing process.
Benchmark # 6: Use strategies (e.g., adapts focus, point of view, organization, form) to write for a variety of purposes (e.g., to inform, persuade, explain, record ideas).

Objectives: Students will be able to…
- Identify and describe ways noise pollution can impact an individual's personal health.
- Differentiate between the intensity of sound and an individual's perception of loudness and relate these to the issue of noise pollution.
- Develop an informational piece using both graphic and written formats that provides the viewer with pertinent information about noise pollution.

Materials:
- Chart paper
- Poster markers
- Five sets of Noise Level Cards
- CD of pre-recorded sounds from Decibel Scale
- CD player
- Charted Decibel Scale
- Poster board
- Paper
- Pencils, crayons and markers

Overview: When sound disrupts or diminishes the quality of life or is proven to be harmful to health and well-being it is considered to be a type of pollution. Though not as evident as other forms of pollution, noise pollution, nevertheless, is a significant problem. Most people consider loud noise to be nothing more than an annoyance, but this annoyance can have severe repercussions. Studies on loud noise have shown a direct correlation to adverse health effects, which can include: irritability, hypertension, heartburn, ulcers, speech issues, hearing loss, sleep deprivation, loss of productivity and cardiovascular problems. Noise pollution has also been determined to have adverse effects on animal life, disrupting habitats and breeding grounds, and threatening the delicate balance of the food web as increased noise levels hinder prey in detecting and avoiding predators.

Recognized as a controllable pollutant the Noise Control Act was passed in 1972 to address this issue. This act empowered the EPA to establish noise emission standards that govern the levels of noise, particularly in the transportation industry. However, in 1981 the federal government decided that noise issues would be best addressed at the state and local levels, leaving the EPA only with the authority to investigate and study noise and its effect, with the purpose of disseminating information to the public. Sources of noise pollution range from harmful to annoying. Those that are of the most concern include: transportation carriers, including trucks, motorcycles, trains and airplanes, construction equipment used in both industrial and residential building, alarms and sirens, landscaping equipment, power tools, audio entertainment equipment and loud animals and neighbors.

Noise intensity is measured in decibels using sensitive instruments, such as sound level meters. For each increase of ten decibels, the noise intensity increases times ten. Also important is the way people perceive loudness. For each increase of ten decibels, the sound seems to double. So a noise that measures 20 decibels is 10 times more intense than a noise at 10 decibels, and it sounds twice as loud. A noise that measures 30 decibels is 100 times more intense than one at 10 decibels, and sounds four times as loud. Proximity is also a factor. The further someone gets from a noise the less the decibels are effective. Therefore, there is a fine distinction between perceived loudness, which is subjective, and the measure of a sounds intensity, but it is likely the more intense the sound the greater chance it will be perceived as loud.

Kid's Speak: Many people don't think of noise pollution as a serious problem, but that is not quite true. Noise pollution is loud sound that can be bothersome and sometimes harmful to our health. Noise pollution can be sound that keep us from sleeping, or makes us feel upset, or causes pain. It can also disturb animals causing them to leave their natural habitats. Noise pollution comes from many different sources, such as trucks, motorcycles, trains and airplanes, equipment used to put up buildings and sometimes even from people playing their music too loudly.

Eco-Fact: The average person has trouble sleeping when noise close by is at 45 decibels. Hearing damage begins at 85 decibels but would have to be sustained for approximately 8 hrs to cause damage. Pain is felt at 100 decibels and immediate damage is done at 140dB.

Procedures:
Before Conducting the Lesson:
- Introduce noise pollution, what it is, its common sources and what can happen because of it.
- Explain to students that loudness is something that varies from person to person. What bothers one may not bother another. A number of factors, such as age and sensitivity, can effect someone's perception of sound. Brainstorm a list of things that make soft, moderate, and loud noise. Do the students agree how to categorize sounds?

How Loud Is Too Loud?:
1. Ask for 4-5 volunteers. Have them come up to the front of the classroom. Seat them facing away from the class. Give each volunteer three cards, each with one of the following: Not Loud, Not Too Loud, Very Loud. Play a series of pre-recorded sounds, one at a time. The sounds should be a mixture of sounds taken from the decibel scale shown below. After each sound ask the volunteers to decide the loudness of the sound and raise the appropriate card above their heads. Have someone in the class keep tally of the responses from each student. Once the activity is complete, make a chart compiling the responses and discuss how some sounds may have bothered some people and not others, and some sounds may bother everyone or no one. Reserve the chart for later use.
2. Explain to students that while humans have different ideas about which sounds are TOO LOUD, there is a way to measure sound. It is important to have an accurate way to measure sound so people know the maximum amount of loudness they can be near before the sound will cause physical damage.
3. Display a chart size version of the decibel scale and review it with students. Now revisit the chart made in Step 1. Ask students to locate each sound on the decibel chart and decide, based on the information in the scale, how they would now rate the sound. Take the general consensus for each sound and record it on the chart.
4. Explain to students that proximity to a sound does affect our perception of loudness. Use thunder as an example. The closer the storm the louder the sound seems. Also point out that while hearing can be damaged by sound over 90 decibels, the sound at that level would need to be sustained for at least 8 hours. OSHA recommends that anyone who is exposed to sounds exceeding 85 dB for any length of time, should wear protective ear covering.

After Conducting the Lesson:
- Relate what was learned about sound back to noise pollution. Based on the information in the decibel scale, why is it important to have regulations regarding noise pollution? Explain while some noise, such as loud conversations may be annoying and cause individuals stress, there is no evidence that it will cause physical harm to anyone. The stress related issues that may arise vary from person to person. However, a case can be made for workers exposed to sustained noise from equipment such as a chain saw or jackhammer. According to the decibel scale they are at risk for physical harm.
- Have students research local and state policies governing noise pollution in the area. Using the information they have learned about noise pollution, ask students to design a poster or pamphlet that could be used to inform the public about the issues of noise pollution.

Extensions:
- Ask students to write a paragraph explaining what the repercussions might be if they were in close proximity to one of the following:
- an exploding firecracker.
- a rock concert, front row.
- a boom box on full volume during an hour bus ride.

GEF Community: Join the GEF community! First, add your school, class or group as a GEF member. It just takes a minute and your students will learn about technology and social networking all in one. Use your class or group page to keep a record of your students' projects, ideas and photos. You can share them with other schools across the nation. Simply complete the basic information and then join the Green Energy Challenge where you can share your body benchmark experience.
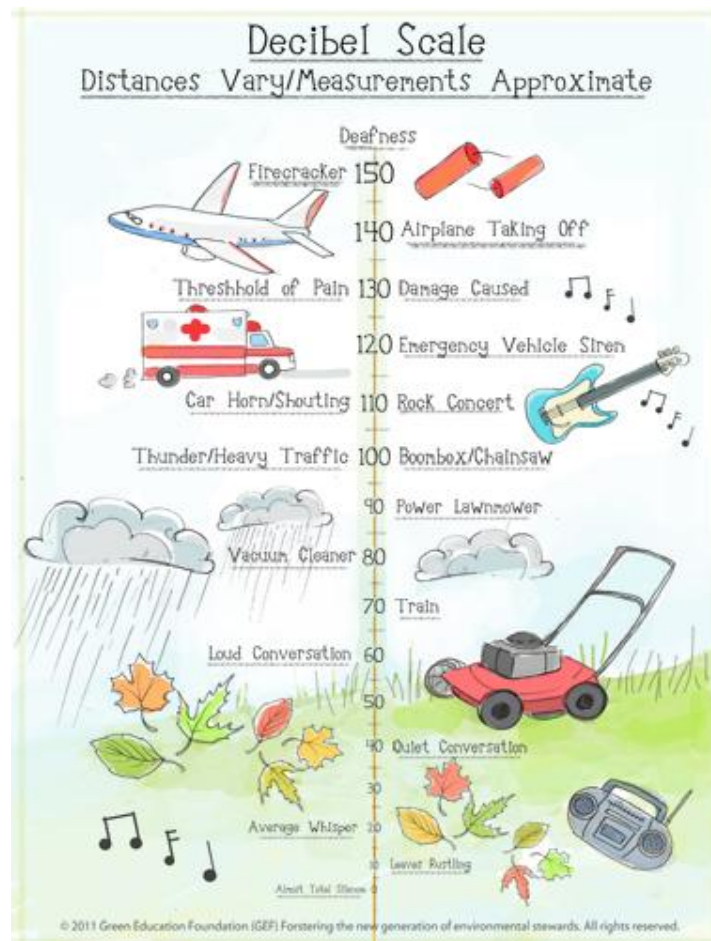
To view full-size lesson plan and print, follow these directions:
1. Click on the image above
2. Click on the small "print" icon at the top left of the lesson
3. Make sure your "Page Scaling" is set to "Fit to Printable Area"
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Click on the second icon from the print button to save your lesson to your computer.
For technical assistance with printing any of the GEF lessons, please contact:
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* All lessons listed on the GEF website have been aligned with the McREL Compendium of Standards and Benchmarks for K-12 Education. GEF curriculum has been developed in accordance with the McREL standards in order to reflect nationwide guidelines for learning, teaching, and assessment, and to provide continuity in the integrity of GEF curricular content from state to state. The decision to utilize McRel's standards was based upon their rigorous and extensive research, as well as their review of standards documents from a variety of professional subject matter organizations in fourteen content areas. Their result is a comprehensive database that represents what many educational institutions and departments believe to be the best standards research accomplished to date. To access the McREL standards database, or for additional information regarding the supporting documentation used in its development, please visit http://www.mcrel.org.